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ON THE
CHARACTERS PRESENTED BY URINE CONTAINING A
DEPOSIT OF OXALATE OF LIME.

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THE chief characters presented by this urine have been very differently stated and described by authors. As I happen, during the last two years, to have examined a considerable number of specimens of this urine, I am led to believe that a short account of these, as verifying some and throwing doubt on other received characters, may not be uninteresting.

First, As to the colour of the urine. I have almost invariably found it of an amber colour, darker than in health. Dr Prout describes it as generally of a pale citron-yellow or greenish hue. In more than one instance I have seen a colour similar to this; but I apprehend that it cannot be considered as in any degree characteristic of the secretion. The amber colour, on the other hand, is likely to lead to a suspicion of the presence of the crystals, more especially when associated with other characters to be immediately described.

Second, The average specific gravity of those specimens I have examined was 1·028, in three or four only was it below 1·015, in not a few above 1·030. In one specimen the specific gravity was 1·034, and in another as high as 1·040; in the two last, the urea was present in such excess, that an immediate crystallisation was caused by the addition of a few drops of nitric acid.

The determination of the average density of oxalic urine is of interest in connexion with its pathological origin, more especially since Dr Prout has asserted its similarity with, and convertibility into, saccharine or diabetic urine. Dr Prout has attributed the lowness in density of some specimens, to the increase in the quantity of urine secreted. Dr Bird states, that he has always found the heaviest specimens to contain the most of the oxalate. The pale urine I have in one or two instances (contrary to expectation) found equal in density to the darker variety, and in such the urea was

small in quantity, but the crystals were present in very large numbers. In these, the density must doubtless be owing to the presence of some other ingredient.

A difference, as Dr Bird¹ has pointed out, not unfrequently exists in the specific gravity of the urine passed in the morning and evening; and on this account it is desirable, that in all cases a specimen of both should be submitted to examination. Of fifteen specimens I have examined lately, the specific gravity was identical in eight. In six the morning urine was the heavier, and in only one the evening.

An important fact in connexion with these discrepancies in the specific gravity is, that in all the evening specimens which were examined, the density of which was lower than those of the morning, the urea, as far as I could judge, appeared to be present in equal if not in greater proportion than in the morning specimens; further, in the latter I am convinced that the oxalate existed in greater quantity, judging from the non-diminution in the specific gravity, as also from the appearance presented by the deposit under the microscope.

Third, The odour exhaled by oxalic urine is aromatic, occasionally approaching to that of the sweetbrier, noticed in urine containing the cystic oxide. I do not think that this peculiar odour is ever entirely absent; by gently heating the urine it was always greatly increased. In the pale urine, and especially in that possessing the greenish-yellow hue, it was always strongest. In the darker variety it was masked by the pungent urinous smell, denoting the existence of urea in excess.

Fourth, Urine containing oxalate of lime, I have found, when placed in favourable circumstances, less prone to decomposition than any other. I mean, of course, oxalic urine in which there existed no association of lithate of ammonia, no great excess of urea, and little phosphatic complication.

Fifth, As regards the quantity of urine secreted, there exists a difference of opinion. Dr Prout² has frequently, if not generally, seen it above the healthy standard. Dr Bird observes, that from actual measurement he has been unable to detect any decided increase.

In the few specimens of oxalic urine I have had an opportunity of examining, in which the urea was present in small quantity, the specific gravity low, and the urine of pale colour, there was a manifest and decided increase in the quantity secreted. As a general rule, the following conclusions in regard to the quantity of urine secreted, will I think be found correct:—1st, That the higher the specific gravity the greater will be the amount of urea present; and that, when this is

¹ Bird's Urinary Deposits, p. 129.

² Prout's Stomach and Renal Diseases, p. 64.

great, the urine will be in natural quantity, or, at least, not greatly exceeding it. And, 2nd, That the lower the specific gravity is, the less will be the amount of urea present, and the secretion of urine will be considerably increased. In neither will there be found any material difference in the oxalic deposit.

Sixth, In all of the specimens, with the exceptions now to be noticed, which I have examined, the reaction was decidedly acid, frequently powerfully so. In a few there existed a tendency to neutrality. In all of these the oxalate was associated with phosphates; for a copious turbidity ensued on the application of heat, cleared by the addition of a few drops of nitric acid.

Seventh, An abundant deposit of epithelium almost invariably accompanies the oxalate of lime, varying considerably, however, in different cases, and at different periods in the same case. I have examined specimens of oxalic urine, almost, if not altogether, free from this admixture, which, in a few days thereafter, contained a large amount of the cells. In such instances, the number of the crystals was simultaneously increased. So common has Dr Bird found the presence of epithelium, that he has stated that its absence is the exception to the general rule; and the circumstance of epithelium existing in considerable quantity in the urine, has, he adds, frequently induced him to examine specimens of urine specially for the oxalate.

Eighth, The oxalate of lime has been described as in general diffused through the urine, and only falling to the bottom of the containing vessel when associated with a quantity of mucus, or a crystalline deposit of some other salt, as, for instance, of uric acid.

I believe, however, that even in specimens of urine in which, upon examination, crystals of no other salt can be detected, a deposit of the oxalate may be seen, and an almost positive opinion with regard to its nature be entertained. The peculiar transparency of oxalic urine, together with the colour alluded to, when seen once or twice, seldom fails to be again recognised.

I have repeatedly verified the truth of this observation. In cases where the oxalate does fall to the bottom of the jar, it is seen to form a small narrow filiform stratum; this, when shaken up, and the urine then exposed to a brilliant light, entirely disappears, and numberless minute shining points are seen scattered throughout.

Ninth, Such are the chief characters presented by this urine; but though, as has been previously observed, their occurring well marked is likely to lead to a suspicion of the presence of the crystals, that can only be properly determined by microscopic examination.

In doing so, I have invariably followed the method proposed by Dr Bird; that operation is undoubtedly by far the most satisfactory: but the process may be rendered more simple, by merely placing a drop or two of the lowermost stratum of the urine under the microscope.

The crystals of oxalate of lime appear as beautifully formed transparent octahedra. Dr H. Bence Jones¹ informs us that Mons. Vigla

was the first who described the octahedral crystals. Dr Jones has himself met with oxalate of lime in the form of cubes, and on one occasion found dodecahedral crystals; the former I have seen repeatedly, the latter never.

Other forms of the oxalate have been described. Dr Bird mentions that of dumb-bells, or rather of two kidneys with their concavities opposed. Of this variety I have seen three specimens from the first examination, associated with, and gradually entirely giving place to, the octahedral crystals.

Lately, an opportunity was afforded me of examining a specimen of urine in which the crystals assumed the form of exact single kidneys. At first I was unable to come to any conclusion in regard to their nature, and I should not finally have determined upon their being crystals of the salt in question, had I not, in rotating the glass in which the deposit was placed, brought into the field of the microscope, one, and afterwards three or four, of the dumb-bell crystals. The single kidneys presented no fractured edge or irregularities, as if they were formed by the mere disunion of the dumb-bells. There existed in the urine, besides the oxalate of lime, some amorphous urate of ammonia, a few crystals of uric acid, and a large deposit of epithelium.

The solubility of the single kidney crystals in nitric, and their insolubility in acetic acids, was determined. I have, since this examination, on several occasions again examined the urine of this patient, but have never seen the single kidneys, their place having been assumed by the more common octahedral variety. The dumb-bell crystals, Dr Bird believes to owe their form to a prolific arrangement of minute acicular crystals; this I have verified myself: and, for the single kidney-shaped crystals, I would claim a similarity of production, though I have allowed to escape the only certain method of determining this point.

The following Table, illustrating the colour, specific gravity, reaction, &c., of fifteen specimens of oxalic urine I have examined lately, exhibits also the complications observed.

Before concluding, I shall append an additional note on some other ingredients I have found in oxalic urine.

In three specimens of albuminous urine depending on the progress of the granular degeneration of the kidney, I have detected the crystals. In two of these they existed in large numbers. In one, the albumen only manifested itself in the urine a short time previous to death, and when the crystals had greatly diminished both as regards number and size. The patient died of phthisis. In a second case, the crystals were in large numbers, and the albumen in large quantity, occurring in the urine of a man who also died of phthisis, com-

TABLE.

Age and Sex of Patient.	Colour of Urine.	Specific Gravity.	Reaction.	Amount of Urea.	Complications.
1. Male, æt. 43.	Dark amber.	1·028.	Acid.	In excess.	Phosphates deposited by heat, on first examination, afterwards urate of ammonia.
2. Male, æt. 40.	Dark amber.	1·028 to 1·040.	Powerfully acid.	In great excess.	Uric acid crystals.
3. Male, æt. 35.	Greenish yellow.	1·024.	Slightly acid.	In small quantity.	Mucus, and dense deposit of epithelium.
4. Male, æt. 32.	Amber.	1·030.	Acid.	Considerable.	Oxalate of lime crystals very large—a few of uric acid, epithelium.
5. Male, æt. 38.	Greenish yellow.	1·030.	Acid.	Large.	None.
6. Male, æt. 25.	Bright amber.	1·030.	Faintly acid.	Small.	Mucus, and a dense deposit of epithelium.
7. Male, æt. 38.	Greenish yellow.	1·030.	Acid.	Natural.	A few uric acid crystals.
8. Male, æt. 42.	Amber.	1·028.	Acid.	Natural.	Crystals of uric acid.
9. Female, æt. 38.	Greenish yellow.	1·030.	Acid.	In excess.	Pink urate of ammonia—a faint trace of albumen—a few blood corpuscles.
10. Male, æt. 35.	Amber.	1·028.	Acid.	Natural.	Crystals of uric acid.
11. Male, æt. 36.	Amber.	1·028.	Acid.	Natural.	Crystals of uric acid—deposit of epithelium.
12. Male, æt. 50.	Amber.	1·028.	Acid.	Increased.	Pink urate of ammonia, and crystals of uric acid.
13. Female, æt. 30.	Dark amber.	1·030.	Acid.	Natural.	Urate of ammonia—slightly phosphatic.
14. Female, æt. 22.	Natural.	1·022.	Acid.	Natural.	White urate of ammonia—a few uric acid crystals.
15. Male, æt. 19.	Amber.	1·032.	Powerfully acid.	Excess.	Urate of ammonia—epithelium.

plicated with degeneration of the kidneys and delirium tremens. This case and the preceding are interesting, as showing the occurrence of the oxalate of lime in phthisical patients; calculi of this salt Liebig has stated never occur in such persons. In the third and only other instance, the albumen was in small quantity, the crystals few but very large.

Spermatozoa and the spermatic globules have been detected in urine containing oxalate of lime. Professor Wolff of Bonn first pointed out this circumstance; and, according to him, oxalate of lime is a constant indication of their existence. This statement is quite opposed to the experience of Dr Bird, and, I believe, of all other observers.

With regard to the association of sugar and oxalate of lime, I may state the few following particulars.

I have only had an opportunity of examining three specimens of diabetic urine with the aid of the microscope, and in two of these oxalate of lime crystals were present. One of the specimens was obtained from a patient lately under Dr Christison's care in the clinical male ward of the Infirmary; and in his urine the crystals were, on first examination, found in considerable numbers. This man left the hospital with his disease somewhat relieved, and his general health improved. I examined his urine again shortly before his dismissal, and detected the crystals; but they were fewer in number, and of greatly reduced dimensions.

The other case, in the urine of which they occurred, was that of a girl, aged three years, of unhealthy appearance. The fact of the urine being passed in very large quantity, was one of the first symptoms which alarmed the friends, and the very first the knowledge of which they put me in possession of.

The urine I examined with great care. It was of a pale colour, of acid reaction; sp. gr. 1.030. Urea present, but in small quantity. By Moore's test the presence of sugar was detected, and, under the microscope, a few of the torulæ or fungoid vegetations so characteristic of diabetic urine, as also a few minute crystals of oxalate of lime. It is interesting, in connexion with this case, that the father of the child presented well-marked symptoms of the oxalic diathesis, verified by examination of his urine.

One word in regard to the presence of the crystals in the urine in special diseases.

I have found them in the urine in two cases of acute rheumatism, in both of which the heart subsequently became affected; in a case of bronchitis, and also in one of pneumonia, the urine of highly inflammatory type, scanty, dark in colour, high specific gravity, strongly acid reaction.

In one or two cases of typhus with intestinal complication; finally, in a case of scorbutus, and in two cases of phthisis—these last have been previously noticed.